Relationships between young drivers' personality characteristics, risk perceptions, and driving behaviour

M. Anthony Machin and Kim S. Sankey

University of Southern Queensland

Correspondence concerning this article should be addressed to Dr. Tony Machin, Department of Psychology, University of Southern Queensland, Toowoomba, 4350. Australia. Telephone +61 7 46312587. Fax +61 7 46312721. Email: machin@usq.edu.au . Web: www.usq.edu.au/users/machin .

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Abstract

Research has shown that inexperienced drivers underestimate the risks associated with a range of driving situations. In addition, personality factors are an important influence on both risk perceptions and driving behaviour. The study investigated the strength of relationship between personality factors, risk perceptions, and driving behaviour among young, mainly inexperienced drivers. One-hundred and fifty-nine students aged between 17 and 20 completed an online questionnaire assessing five facets of personality, four components of risk perceptions, and one measure of driving behaviour. Using structural equation modeling as a means of assessing the overall fit of each model, 39% of the variance in young drivers' speeding was accounted for by excitement-seeking, altruism, their aversion to risk taking, and their own likelihood of having an accident with altruism and aversion to risk taking both showing moderate negative relationships. Road safety interventions should examine whether they strengthen young drivers' appreciation of the impact of their actions on others through positive reinforcement of altruistic norms.

Keywords: Risk perceptions; altruism; excitement-seeking; speeding.

1.1 Introduction

In Australia, young, inexperienced drivers are a small percentage of licensed drivers and yet, these drivers make up a much larger percentage of those experiencing traffic crashes and injuries (Senserrick & Haworth, 2004). Researchers have concluded that young drivers' involvement in risky driving behaviour such as speeding is a major contributing factor to a higher rate of crashes and injuries (Laapotti, Keskinen, Hatakka, & Katila, 2001; Vassallo et al., 2007; West & Hall, 1997). The focus of this study was on the individual difference variables that were related to greater involvement in risky driving which included factors associated with risk perception and aspects of drivers' personality. Personality factors are also expressed in risky behaviour in other domains such as extreme and risky sports, vocations, substance abuse, unsafe sex, and crime (Zuckerman, 2006). Therefore, we sought to determine the overall importance of personality factors and risk perception in a structural model of risky driving behaviour.

1.2 Risky Driving Behaviour

Risky driving behaviour may include self-assertive driving, speeding, and rule violations. Speeding as a risky driving behaviour has been studied by many researchers (Aarts & van Schagen, 2006; Jonah, 1997; Lam, 2003). Excessive driving speed for the road conditions is considered one of the most important contributors to road crashes, regardless of driver age and level of skill (Elliott, Armitage, & Baughan, 2004). Even when aware of the potential consequences for speeding, drivers in Australia still indicate involvement in speeding behaviour (Brown & Cotton, 2003). Clarke, Ward and Truman (2002) also suggested that speed was the most common factor involved in driving offence among young drivers. West and Hall (1997) found that speed was a significant contributor to specific kinds of crashes (that is, active shunts, right of way violations, active reversing, and loss of control crashes) along with both (poor) attitudes towards driving and social deviance. McKenna and Horswill (2006) suggested that involvement in speeding behaviour may also be due to a low probability of negative outcome. For example, individuals may consider involvement in a crash as less likely than being caught by the police.

The research described above demonstrates that risky driving behaviour has the potential to cause harm to young drivers, passengers and other road users. The current study utilised the speeding scale used by Ulleberg and Rundmo (2003) as a measure of risky driving behaviour.

1.3 The Influence of Risk Perceptions

In relation to driving behaviour, risk perception refers to, "the subjective experience of risk in potential traffic hazards" (Deery, 1999, p. 226). Therefore, risk perception is considered a precursor of actual driving behaviour. Many researchers have indicated that risk perception is negatively related to risk behaviour in general (Cohn, Macfarlane, Yanez, & Imai, 1995). That is, a higher level of perceived risk for a particular behaviour is associated a lower chance that an individual would take part in that behaviour.

There is some controversy about the direction of effect between risk perception and driving behaviour. Horvath and Zuckerman (1992) indicated that a sense of competence may increase with involvement in risk behaviour that does not produce negative consequences, such as injury or penalty. In that sense, risk perception may be a consequence, not a cause of behaviour. Ulleberg and Rundmo (2003) also

questioned whether there is a causal relationship between risk perception and behaviour. Although risk perception was moderately correlated with risk behaviour while driving (r = -.22), when attitudes were controlled for, the authors found a non-significant association between risk perception and risky driving behaviour among a sample of young Norwegian drivers. However, as there were only two items included in their risk perception scale, we must question whether the risk perception domain was adequately represented.

Rundmo and Iversen (2004) suggested that most research has emphasised a cognitive, or belief-based component of risk perception, which focuses on the way young drivers perceive and process information (see Brown & Cotton, 2003; Deery & Fildes, 1999; Horvath & Zuckerman, 1992; Sarkar & Andreas, 2004). However, when measuring perceived risk, Rundmo and Iversen considered it was important to distinguish between cognitive-based and affective-based subjective assessments. Affective components of risk perception such as worry and concern have also been found to be a predictor of risky driving behaviour (see Rundmo & Iversen, 2004; Ulleberg & Rundmo, 2003). However, McKenna and Horswill (2006) found that worry and concern appeared to have less influence than other variables (e.g., legal constraints, mood, passengers, journey time, economics, and thrill), and accounted for only 2% of the variance in both speeding and driving violations.

Therefore, in the present study, the combined worry and concern items used by Rundmo and Iversen (2004) were used as a measure of the affective aspect of risk perception. A number of other scales that focused on the cognitive subjective judgements of risk perception were drawn from a survey developed by Dorn and Machin (2004). These scales included items related to perceived likelihood of being involved in an accident, driving efficacy, and aversion to risk taking.

1.4 Personality and Risky Driving

Previous research has also indicated that personality variables are direct contributors to involvement in risky driving behaviour (Dahlen, Martin, Ragan & Kuhlman, 2005; Schwebel, Severson, Ball & Rizzo, 2006; Ulleberg & Rundmo, 2003). Significant indirect effects have also been found with personality acting as a distal influence on driving behaviour through risk perception (Rundmo & Iversen, 2004; Ulleberg & Rundmo).

An Australian study of young adults' driving behaviour undertaken by Vassallo et al. (2007) utilised longitudinal data of the psychosocial development of young people from infancy to early adulthood. The results of the study indicated that high levels of anti-social behaviour and aggression, and low levels of empathy were precursors to young drivers' involvement in risky driving and speeding violations. Low levels of anxiety were also associated with involvement in speeding violations. This research found differences between those who engaged in high and low levels of risky driving and speeding behaviour once eligible to drive were evident by early adolescence (12 to 14 years of age).

The same personality variables used by Ulleberg and Rundmo (2003) were employed as predictors of driving behaviour in the present research. These scales assessed anxiety, anger, excitement-seeking, altruism, and normlessness.

1.5 Aims and Conceptual Model

The present study explored the combined effects of specific risk perception variables and specific personality variables on driving behaviours of young drivers. Specific variables were studied to provide more targeted information for the

development of driving interventions. Personality variables and risk perception variables were expected to directly influence speeding behaviour while the risk perception variables were also expected to mediate the influence of the personality variables on speeding behaviour.

2.1 Method

2.1.1 Participants

A total of 159 participants completed the online survey with 17 aged 17 years, 42 aged 18 years, 46 aged 19 years, and 53 aged 20 years. Forty-six participants were male, and 112 were female. The sample was drawn from all faculties of the University of Southern Queensland (USQ) student population.

2.1.2 Measures

A cross-sectional online survey instrument, named the Road Safety Behaviour (RSB) Survey, was developed to examine personality and risk perception factors that may influence risky driving behaviour among young drivers aged between 17 and 20 years.

2.1.2.1 Demographics. The demographic section of the survey consisted of seven items that requested information related to gender, age (in yearly increments of 17, 18, 19, and 20), level of licence (e.g., What level of licence do you currently hold?), driving instruction (e.g., Who taught you how to drive?), car ownership (e.g., Who does the car you most often drive belong to?), and frequency of driving (e.g., How often do you drive?).

2.1.2.2 Personality scales. The personality measures consisted of five scales related to personality variables considered in prior research to be predictors of driving behaviour. These factors which included anxiety, anger, excitement-seeking, altruism and normlessness (Ulleberg & Rundmo, 2003). Four of the scales are facets of the Big Five personality factors (shown in brackets): anxiety (Neuroticism), anger (Neuroticism), excitement-seeking (Extraversion), and altruism (Agreeableness). The items were selected from the International Personality Item Pool (IPIP; Goldberg, 1999). The IPIP provides freely available measures of the NEO PI-R constructs in the public domain (see http://ipip.ori.org). The correlations between the IPIP scales and the equivalent NEO-PI-R facet scales among an adult community sample were between .67 and .76. When the scales were corrected for measurement error, the correlations were between .90 and .95 (Goldberg). Goldberg reported Cronbach's alpha coefficients for Anxiety ($\alpha = .83$), Anger ($\alpha = .88$), Excitement-Seeking ($\alpha = .78$), and Altruism ($\alpha = .73$) among the adult community sample.

The Normlessness variable was measured with the four item Normlessness scale developed by Kohn and Schooler (1983) and is similar to the dutifulness facet of Conscientiousness. It was also used by Ulleberg and Rundmo (2003) and had an internal consistency of .71.

2.1.2.3 Risk perception scales. The risk perception scales consisted of an affect-based Worry and Concern scale (Rundmo & Iversen, 2004), and three cognition-based scales developed by Dorn and Machin (2004). The Worry and Concern scale contained six items related to worry and concern about traffic injury and risk (e.g., To what extent are you feeling unsafe that you yourself could be injured in a traffic accident?). Rundmo and Iversen obtained Cronbach's alpha coefficients for the individual worry scale ($\alpha = .89$), and the concern scale ($\alpha = .81$) for a Norwegian adolescent (18 to 24 years of age) sample, while the internal consistency of the affect-based risk perception scales was acceptable.

The cognition-based scales included Likelihood of Accident (for self and others), Efficacy (perceived confidence about driving in certain conditions) and Aversion to Risk Taking (perceived danger of certain actions while driving) from the Learner Driving Experience Questionnaire, developed by Dorn and Machin (2004).

The Likelihood of Accident scale was scored on a 10-point rating scale. Respondents were asked to indicate the likelihood of accident for both self and others (e.g., Please rate your chances of having an accident within the next 12 months), in 10 % increments ranging from 1 = 0 to 10% (*no chance*), to 10 = 90 to 100% (*extremely high*).

The Efficacy and Aversion to Risk Taking scale items were scored on a 5-point rating scale, ranging from 1 (*not at all*) to 5 (*extremely*). The five Efficacy items measured the extent of respondent confidence about driving in certain conditions (e.g., How confident are you about driving on unfamiliar roads?). Higher scores on the scale indicated a higher level of perceived confidence about driving in certain conditions.

The eight Aversion to Risk Taking items measured how dangerous respondents thought certain actions were while driving (e.g., Running a red light). These items did not ask drivers whether they actually performed any of these behaviours, and therefore the measure was focused on drivers' cognitions rather than their behaviour. Higher scores on the scale indicated a higher level of perceived danger for certain actions while driving. The Cronbach alpha coefficient for a shorter (six item) version of this scale used by Machin and De Souza (2004) was .74.

2.1.2.4 Driving behaviour scale. The six item Speeding scale (Ulleberg & Rundmo, 2003) measured how often respondents engaged in various speeding behaviours (e.g., "I exceed the speed limit in build-up areas (more than 10 km/h)", "I exceed the speed limit on country roads (more than 10 km/h)", "I overtake the car in front when it is driving at the speed limit", "I drive too close to the car in front", "I bend the traffic rules in order to get ahead in traffic", and "I ignore traffic rules in order to get ahead in traffic"). The Cronbach's alpha coefficient for Speeding was .86.

2.1.3 Procedure

Undergraduate USQ students, aged between 17 and 20 years, were recruited across faculties by email, brochure, and personal contact. With each form of contact students were provided information about the research, including a brief explanation of the purpose of the research, incentives offered, how to participate, and anonymity and confidentiality assurances. These procedures were approved by the Human Ethics Research Committee at USQ.

3.1 Results

Table 1 contains the means, standard deviations, Cronbach Alpha values and intercorrelations among the variables. At the generally accepted level ($\alpha \geq .70$), the internal consistency of all scales was acceptable (Steiner, 2003). Speeding was correlated with three of the risk perception variables ($r = .25$, $p < .01$ with Likelihood of Accident, $r = .22$, $p < .01$ with Efficacy, and $r = -.49$, $p < .01$ with Aversion to Risk Taking) and four of the personality variables ($r = .32$, $p < .01$ with Anger, $r = .33$, $p < .01$ with Excitement-Seeking, $r = -.37$, $p < .01$ with Altruism, and $r = .34$, $p < .01$ with Normlessness).

3.1.1 Hierarchical Regression Analysis

Initially, a hierarchical multiple regression analysis was conducted in which Speeding was regressed on the predictor variables controlling for gender. In this analysis, gender was entered first, with the risk perception variables and the

personality variables entered at steps two and three respectively. The reason for conducting this analysis was to estimate the influence of the risk perception and personality variables over and above gender and to determine which of the variables should be included in the analysis of mediating effects to follow using structural equation modeling.

The results of regressing Speeding on Gender, the risk perception variables and the personality variables were as follows. At the first step, Gender explained 3% (2% adjusted) of the variance in Speeding with $R^2 = .03$, F (1, 153) = 3.90, $p = .05$. At the second step, the four risk perception variables explained an additional 30% (28% adjusted) of the variation in Speeding, with $R^2 = .32$, F (4, 149) = 16.33, $p < .001$. At the third step, the five personality variables explained an additional 11% (9% adjusted) of the variation in Speeding, with $R^2 = .43$, ΔF (5, 144) = 5.60, $p < .001$. While Gender was not a significant predictor, several of the risk perception and personality variables accounted for significant unique variance in Speeding. At step 2, Likelihood of Accident ($\beta = .27$, $t = 3.67$, $p < .001$), Efficacy ($\beta = .19$, $t = 2.64$, $p < .01$), and Aversion to Risk Taking ($\beta = -.43$, $t = -5.73$, $p < .001$) were significant unique predictors accounting for 6%, 3%, and 15% of the variance respectively. At step 3, Excitement-Seeking ($\beta = .18$, $t = 2.27$, $p < .05$) and Altruism ($\beta = -.23$, $t = -2.92$, $p < .01$) were significant unique predictors accounting for 2% and 3% of the variance respectively.

3.1.2 Structural Equation Modelling

The initial structural equation model focused on just the significant predictors of Speeding rather than including all of the personality and risk perception variables. This model was specified with Excitement-Seeking and Altruism directly predicting Speeding, Likelihood of Accident, Efficacy, and Aversion to Risk Taking, while Likelihood of Accident, Efficacy, and Aversion to Risk Taking also were specified as direct predictors of Speeding. This model was tested using Amos 6.0 (Arbuckle, 2005) and the fit statistics for this model indicated that it was not a good fit to the data, $\chi^2 = 12.26$, $df = 6$, $p = .06$, CFI = .94, *TLI* = .82, *RMSEA* = .08. A simplified model was then specified with the Efficacy variable omitted on the basis that it was the weakest direct predictor of Speeding. The variance explained by this simplified model was 39% compared to 43% by the overall model in the hierarchical multiple regression which was judged to be only a small reduction in predictive power. The fit statistics for this model indicated that it was a good fit to the data, $\chi^2 = .11$, $df = 2$, $p = .95$, *CFI* = 1.00, *TLI* = 1.15, *RMSEA* = .00. The results for this model are presented in Figure 1. The standardised regression coefficients for all paths are shown, although one of the paths (from Excitement-Seeking to Likelihood of Accident) was not significant.

Inspection of the standardised total effects showed that the direct and indirect effects of Altruism (-.38) and Excitement-Seeking (.34) were comparable to the direct effects of Aversion to Risk Taking (-.37), and outweighed the direct effects of Likelihood of Accident (.16). Therefore, the effects of Altruism and Excitement-Seeking on Speeding were partially mediated by the risk perception variables, particularly Aversion to Risk Taking.

4.1 Discussion

The first aim of the study was to examine the direct influence of the five personality variables (Anxiety, Anger, Excitement-Seeking, Altruism, and Normlessness) and the four risk perception variables (Worry and Concern, Likelihood of Accident, Efficacy, and Aversion to Risk Taking) on driving behaviour (Speeding).

The second aim was to determine whether the risk perception variables mediated the influence of the personality variables on driving behaviour. While the conceptual model allowed potentially all of the risk perception variables to be mediators, we used the results of the hierarchical multiple regression analyses to select those predictor variables that had been shown to account for unique variance in driving behaviour. The structural equation model was a good fit to the data and the total effects (both direct and indirect) of the four predictors enabled the relative importance of the predictor variables to be compared. We can conclude that the two personality variables were of equal importance to the participants' Aversion to Risk Taking in influencing speeding behaviour and that Aversion to Risk Taking partially mediated the effects of the personality variables on Speeding.

Previous research has shown that young, inexperienced drivers who tended to be involved in higher levels of speeding during their driving also underestimated the potential risk of driving situations, and overestimated their level of skill as drivers (Castella & Perez, 2004; Deery, 1999; McKenna & Horswill, 2006). We have shown that, in addition to being inexperienced, young drivers with higher levels of excitement-seeking, lower levels of altruism, greater perceived likelihood of an accident, and a lower aversion to risk taking are also more likely to report greater speeding. Vassallo et al. (2007) reported that the young adolescents (12-14 years) who later reported greater speeding behaviour were also more antisocial. Greater speeding was also associated with greater aggression as well as being more antisocial when data from mid-to-late adolescence (15-18 years) was compared. In early adulthood (19-20 years), the factors that differentiated between those who reported more speeding were their level of antisocial behaviour, and their amount of contact with the criminal justice system. There was also a marked gender difference with a greater proportion of young males in the groups reporting the most speeding violations. The variable in the current study which is most closely related to antisocial behaviour is Altruism which is a concern for the welfare of others (i.e., prosocial behaviour).

To a lesser extent, Likelihood of Accident was also a positive predictor of Speeding behaviour. However, it is quite possible that Likelihood of Accident is also a consequence of Speeding. The significant regression coefficient does not establish causality and drivers who speed more may also recognise that there is a greater risk of crashing.

The other positive influence on Speeding was Excitement-Seeking. Previous research indicated that sensation-seeking directly contributed 10% to 15% of the variance in speeding behaviour (Jonah, 1997), indicating that Excitement-Seekers drove faster than other drivers (Burns & Wilde, 1995; Sumer, 2003). In this study, Excitement-Seeking was both a direct predictor of Speeding uniquely explaining 2% of its variance, as well as an indirect predictor through its influence on Aversion to Risk Taking. A greater level of Excitement-Seeking was associated with a lower Aversion to Risk Taking which in turn negatively predicted Speeding.

Vassallo et al. (2007) also confirmed that self-reported antisocial behaviour was one of the strongest influences on later risky driving behaviour. Other important influences were the level of involvement with peers who were antisocial as well as the level of contact with police regarding driving offences. Similar results were found for crash involvement, with the level of antisocial behaviour, contact with police over driving offences, and association with antisocial peers differentiating those who had experienced crashes from those who had not. It seems that a driver's attitudes about the social acceptability of speeding or risky driving may be the strongest influence on how likely that driver is to speed or take risks whilst driving.

Among the non-significant correlations that we found, we will comment on those for which previous research exists. Worry and Concern was not significantly correlated Speeding. Rundmo and Iversen (2004) reported that safer self-reported driving behaviours were associated with more emotionally disturbing judgements of traffic situations. McKenna and Horswill (2006) found that, although Worry and Concern made a small unique significant contribution to the prediction of Speeding, it was less influential than other variables (e.g., legal constraints, journey time, mood, and thrill-seeking). McKenna and Horswill suggested that concern about being involved in an accident is probably at a much lower level than concern about being caught speeding by the police. This may explain the weak relationships obtained in this study and point to the need to measure a range of foci of concern rather than just the risk of accident and injury.

Anxiety was also not significantly correlated with Speeding. Vassallo et al. (2007) found that by early adulthood (19-20 years), drivers who had no speeding violations were more anxious and depressed than those with one or more speeding violations. Our result suggests that anxiety is not related to driving behaviour. Therefore, current road safety campaigns that focus on increasing the level of fear and anxiety may only serve to influence those drivers who are already somewhat anxious about driving and be ignored by other drivers (Harrison & Senserrick, 2000).

4.1.1 Implications and Application of Findings

Speeding is strongly related to a lower Aversion to Risk Taking. In addition, Aversion to Risk Taking acts as a mediator of the influence of key aspects of personality on speeding. These findings have implications for the development of driver education and training programs. Assessment of drivers' tendency toward Excitement-Seeking and Altruism could be used as a screening procedure when young drivers undertake initial driver training. These personality characteristics may also influence other kinds of risky behaviour which are common during adolescence (Reyna & Farley, 2006). Identification of "risk-taking dispositions" would alert educators and trainers to the likelihood of some adolescents failing to exercise a reasonable level of caution and being less adverse to risk taking in a range of areas.

Ajzen's (2001) Theory of Planned Behaviour (TPB) suggested that perceived normative beliefs are an important determinant of behavioural intentions. With respect to speeding, the TPB has been used as a behavioural change model for a three-year road safety advertising campaign (Stead, Tagg, MacKintosh & Eadie, 2005). Stead et al. suggested that speeding does not suffer from the same stigma as drink-driving, and is accepted by the majority of drivers. The "Foolsspeed" campaign began in Scotland in 1999 and sought to influence public attitudes, subjective norms and perceived behavioural control regarding speeding. The results of the advertising campaign showed that neither subjective norms nor perceived behavioural control had altered, although changes occurred on attitude towards speeding and affective beliefs, particularly among those who sped frequently.

Self-awareness exercises may be included in driver education programs to help young drivers gain insight into how their tendency to crave excitement and the importance that they place on the welfare of other drivers, as well as the level of danger that the driver perceives in a situation, may affect their willingness to speed. It may be far more effective to assist young drivers to reflect on their personality and how it influences their decisions rather than just to emphasise the importance of following the road rules. Abiding by the traffic rules should be placed in the context of societal goals that depend on the cooperation and contribution of all citizens in that society. Therefore, public road safety campaigns could focus on the development of

interventions that strengthen young drivers' appreciation of the impact of their actions on others through positive reinforcement of altruistic norms. This is an important foundation for all societies that has been captured by the maxim, "do unto others as you would have them do unto you". We suggest that the golden rule for safer driving is to "*Drive* unto others as you would have them *drive* unto you".

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Table 1

Mean, Standard Deviation, Coefficient Alpha Statistics, and Intercorrelations among Driving Behaviour, Risk Perception and Personality Variables of the Road Safety Behaviour Survey (N = 155)

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10
1. Speeding	11.79	4.47	.82									
2. Worry & Concern	16.05	4.46	-.11	.88								
3. Likelihood of Accident	3.20	1.79	.25**	.29**	-							
4. Efficacy	16.72	3.91	.22**	-.28**	-.21**	.88						
5. Aversion to Risk Taking	28.28	4.84	-.49**	.29**	-.07	-.19*	.79					
6. Anxiety	27.51	6.81	.11	.23**	.25**	-.18*	-.01	.85				
7. Anger	22.64	6.41	.32**	.09	.26**	-.08	-.11	.60**	.88			
8. Excitement-Seeking	32.59	6.98	.33**	-.15	.03	.25**	-.37**	-.25**	-.03	.84		
9. Altruism	36.57	4.84	-.37**	.04	-.20*	.01	.17*	-.19*	-.48**	.02	.84	
10. Normlessness	7.23	2.79	.34**	-.16*	.02	.19*	-.35**	.09	.25**	.44**	-.30**	.78

Note. Cronbach Alphas are on the diagonal. * $p < .05$ (2-tailed), ** $p < .01$ (2-tailed).

6.1 List of Figures

Figure 1. Predicting Speeding from Excitement-Seeking, Altruism, Likelihood of Accident and Aversion to Risk Taking (*n* = 158).